

What is claimed is:

1. A nuclear magnetic resonance (NMR) logging tool for conducting measurements of a down hole formation, comprising:

- 5 (a) a permanent magnet having longitudinal axis;
(b) a nonmagnetic metal drill collar surrounding the permanent magnet;
(c) an antenna mounted on the outside of said drill collar; and
(d) one or more soft-magnetic elements installed in proximate relationship with the antenna, said soft-magnetic elements shaping radio frequency (RF) fields generated by the
10 antenna;
(e) a motion detector generating signals corresponding to motions of the NMR logging tool.

15 2. The NMR tool of claim 1 further comprising a down hole signal processor for processing NMR signals from said formation.

3. The NMR tool of claim 1 further comprising a drill bit for drilling a borehole in said down hole formation.

4. The NMR tool of claim 1 further comprising one or more pre-polarization magnets positioned proximate said permanent magnet along its longitudinal axis.

20 5. The NMR tool of claim 4 comprising two pre-polarization magnets each pre-polarization magnet positioned at an end of said permanent magnet.

6. The NMR tool of claim 1, wherein said permanent magnet comprises a plurality of magnet segments.

7. The NMR tool of claim 6, wherein said plurality of magnet segments is made of
25 rare earth materials.

8. The NMR tool of claim 1 further comprising one or more auxiliary antennas to enable sampling of radio frequency (RF) flux from the antenna.